

WHAT IS CLAIMED IS:

Aa > 1. An exposure apparatus that transfers a pattern of a mask onto a substrate by irradiating said mask with exposure-illumination light, the exposure apparatus comprising:

5 a plurality of sealed rooms in each of which said mask is temporarily stored, including a mask room that covers at least an optical path near said mask of the optical path of said exposure-illumination light from
10 said mask to said substrate; and

wherein said sealed rooms are filled with the same kind of specific gas, or different kinds of specific gases, having a characteristic of absorbing little of said exposure illumination light, and wherein the
15 concentration of impurities in said specific gas in at least one of said sealed rooms is different from the concentration of impurities in said specific gas in said mask room.

20 2. An exposure apparatus according to claim 1, wherein said plurality of sealed rooms include said mask room and a mask-reserve room that is arranged adjacent to said mask room and that temporarily contains said mask before being carried into said mask room.

25 3. An exposure apparatus according to claim 2, wherein the concentration of impurities in said specific gas filling said mask room is lower than a first

concentration, and wherein the concentration of impurities in said specific gas filling said mask-reserve room is equal to a second concentration that is about 10 to 100 times said first concentration.

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4. An exposure apparatus according to claim 3,
wherein said mask-reserve room has two gates that include
a gate provided on the boundary with said mask room and
each of which is opened and closed by a door,
10 said exposure apparatus further comprising:

a gas-replacement mechanism that replaces gas in said mask-reserve room with said specific gas having an impurity concentration being about said second concentration before carrying said mask into said mask room.

5. An exposure apparatus according to claim 4,
wherein when said mask is carried into said mask-reserve
room, said gas-replacement mechanism performs said gas
replacement by supplying said specific gas to said mask-
20 reserve room after discharging gas in said mask-reserve
room to decrease the internal pressure.

6. An exposure apparatus according to claim 4,
25 wherein a door that opens and closes said gate provided
on the boundary with said mask room is a high-speed
shutter.

7. An exposure apparatus according to claim 2,
wherein in a chamber constituting said mask-reserve room,
a delivery port is provided into and from which a sealed-
type mask container containing said mask and having a
5 door that can be opened and closed is loaded and unloaded,
and

wherein in said mask-reserve room, an open-close
mechanism is provided which opens and closes the door of
said mask container with isolating the inside of said
10 mask-reserve room from the outside.

8. An exposure apparatus according to claim 7,
wherein said mask-reserve room is divided into a
plurality of sub-rooms including a first room adjacent to
15 said mask room and a second room where said open-close
mechanism is provided, by division walls having a door
that can be opened and closed, and

wherein the concentrations of impurities in said
specific gas in said plurality of sub-rooms are set such
20 that the concentration of impurities in said specific gas
in said first room is not lower than said first
concentration and lower than the concentration of
impurities in said specific gas in said second room.

25 9. An exposure apparatus according to claim 7,
wherein said mask container is a bottom-open-type mask
container on the bottom of which said door is provided.

10. An exposure apparatus according to claim 2,
wherein in a path for carrying said mask, an energy-beam-
emitting portion is provided which irradiates said mask
with an energy beam in an ultraviolet range.

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11. An exposure apparatus according to claim 10,
wherein said energy-beam-emitting portion is provided in
said mask-reserve room.

10 ~~A3~~ 12. An exposure apparatus according to claim 2,
wherein in said mask-reserve room, a mask-transport
system is arranged which transports said mask from and to
said mask room.

15 13. An exposure apparatus according to claim 1,
further comprising:

a projection optical system that projects said exposure-illumination light emitted from said mask onto said substrate, and

20 wherein said mask room covers the optical path
between said mask and said projection optical system.

14. An exposure apparatus according to claim 1,
further comprising:

25 a mask-store portion that stores said mask; and
 a mask-transport system that transports said mask
 between said mask-store portion and said mask room.

15. An exposure apparatus according to claim 14, wherein said mask-store portion is a mask library that stores a plurality of masks that are of the same type as said mask.

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16. An exposure apparatus according to claim 15, wherein said mask library stores said mask contained in a mask case, further comprising:

10 a gas-supply mechanism that can supply said specific gas into said mask case stored.

17. An exposure apparatus according to claim 16, wherein said mask case is a sealed-type mask case that
15 stores at least a mask and that has a door that can be opened and closed,

wherein said mask-transport system transports said mask contained in a mask case to any one of said sealed rooms except for said mask room, and wherein in said
20 sealed room a door-open-close mechanism is provided which opens and closes the door of said mask case.

18. An exposure apparatus according to claim 14, wherein said mask-store portion is a sealed-type mask
25 container that is arranged inside or outside any one of said sealed rooms except for said mask room, that stores at least a mask and that has a door that can be opened and closed, and

wherein in said sealed room, an open-close mechanism is provided which opens and closes the door of said mask container with isolating the inside of said sealed room from the outside.

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A4> 19. An exposure apparatus according to claim 1, further comprising:

10 a substrate room constituted by a sealed room that covers at least an optical path near a substrate of the optical path of said exposure-illumination light from said mask to said substrate and that is filled with said specific gas.

20. An exposure apparatus according to claim 19, further comprising:

a substrate-reserve room constituted by a sealed room that is arranged adjacent to said substrate room and that temporarily stores said substrate before being carried into said substrate room; and

20 a gas-replacement mechanism that replaces gas in said substrate-reserve room with said specific gas.

A5> 21. An exposure apparatus according to claim 19, further comprising:

25 a projection optical system that projects said exposure-illumination light emitted from said mask onto said substrate, and

wherein said substrate room covers the optical path between said substrate and said projection optical system.

22. An exposure apparatus that transfers a pattern
5 of a mask onto a substrate by irradiating said mask with
exposure-illumination light, the exposure apparatus
comprising:

a plurality of sealed rooms in each of which said substrate is temporarily stored, including a substrate room that covers at least an optical path near said substrate of the optical path of said exposure-illumination light from said mask to said substrate; and

wherein said sealed rooms are filled with the same kind of specific gas, or different kinds of specific gases, having a characteristic of absorbing little of said exposure illumination light, and wherein the concentration of impurities in said specific gas in at least one of said sealed rooms is different from the concentration of impurities in said specific gas in said substrate room.

23. An exposure apparatus according to claim 22,
wherein said plurality of sealed rooms include said
substrate room and a substrate-reserve room that is
25 arranged adjacent to said substrate room and that
temporarily contains said substrate before being carried
into said substrate room.

24. An exposure apparatus according to claim 23,
wherein said substrate-reserve room has two gates that
include a gate provided on the boundary with said
substrate room and each of which is opened and closed by
a door,
5 further comprising:

a gas-replacement mechanism that replaces gas in said substrate-reserve room with said specific gas having an impurity concentration being a predetermined concentration before carrying said substrate into said substrate room.

25. An exposure apparatus according to claim 24,
wherein a door that opens and closes said gate provided
15 on the boundary with said substrate room is a high-speed
shutter.

26. An exposure apparatus according to claim 24,
wherein when said substrate is carried into said
20 substrate-reserve room, said gas-replacement mechanism
performs said gas replacement by supplying said specific
gas to said substrate-reserve room after discharging gas
in said substrate-reserve room to decrease the internal
pressure.

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27. An exposure apparatus according to claim 23,
wherein in said substrate-reserve room, a substrate-

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transport system is arranged which transports said substrate from and to said substrate room.

28. An exposure apparatus according to claim 22,
5 further comprising:

a substrate stage that moves with holding said substrate; and

an interferometer that projects a measurement beam through a light-transmission window onto a reflection
10 surface provided on said substrate stage and detects the position of said substrate stage by receiving the reflected light.

29. An exposure apparatus according to claim 22,
15 further comprising:

a substrate stage that moves parallel to a guide plane with holding said substrate; and

a gas-static-pressure bearing unit that is provided on said substrate stage and levitates said substrate
20 stage with respect to said guide plane in non-contact and in a supported manner by static pressure of said specific gas in a gap between said guide plane and said bearing unit, said static pressure being generated by blowing said specific gas against said guide plane.

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A7> 30. An exposure apparatus that transfers a pattern of a mask onto a substrate by irradiating said mask with

exposure-illumination light, the exposure apparatus comprising:

5 a sealed room that stores said mask so as to expose said substrate to said exposure-illumination light and that is filled with specific gas having a characteristic of absorbing little of said exposure illumination light; and

10 a gas-charging mechanism that charges a sealed-type mask case containing said mask with said specific gas again after the completion of exposure using said mask in said sealed room.

31. An exposure apparatus according to any one of claims 4, 20 and 24, wherein said gas-replacement
15 mechanism performs said gas replacement by making said specific gas flow continuously.

32. An exposure apparatus according to one of claims 5 and 26, wherein said gas-replacement mechanism
20 spends time not less than 10 seconds in performing said gas replacement.

33. An exposure apparatus according to any one of claims 1 through 30, wherein part of at least one of said
25 sealed rooms, which part contacts said specific gas, is coated with material emitting little gas.

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34. An exposure apparatus according to any one of claims 1 through 30, wherein said specific gas is supplied and used in a circulated manner in at least one of said sealed rooms.

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35. An exposure apparatus according to claim 34, wherein said sealed room where specific gas is used in a circulated manner is connected with a supply system and exhaust system for said specific gas, and wherein a
10 chemical filter that removes said impurities is arranged in both said supply system and exhaust system.

18 36. An exposure apparatus according to any one of
claims 1 through 30, wherein said exposure-illumination
15 light is light having a wavelength not longer than 200nm.

37. An exposure apparatus according to claim 36,
wherein said specific gas is substantially composed of
any number of gases out of nitrogen, argon, helium, neon
and krypton.

38. An exposure method that transfers a pattern of a mask onto a substrate by irradiating said mask with exposure-illumination light, the exposure method comprising:

a first step of filling a sealed space that covers at least an optical path near said mask of the optical path of said exposure-illumination light from said mask

a second step of temporarily storing said substrate in a reserve room adjacent to said sealed space before carrying said substrate into said sealed space and

replacing gas in said reserve room with said low-absorbent gas that has an impurity concentration not lower than a first concentration and lower than a second concentration; and

- 5 a third step of transporting said substrate to a predetermined position in said sealed space and transferring said pattern onto said substrate.

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40. An exposure method according to one of claims
10 38 and 39, wherein in the gas replacement of said second step, said low-absorbent gas is supplied to said reserve room after discharging gas in said reserve room to decrease the internal pressure.

- 15 41. An exposure method according to one of claims 38 and 39, wherein said exposure-illumination light is light having a wavelength not longer than 200nm.

42. An exposure method according to claim 41,
20 wherein said low-absorbent gas is substantially composed of any number of gases out of nitrogen, argon, helium, neon and krypton.

- A10 > 43. A device manufacturing method including a
25 lithography process, wherein in said lithography process, exposure is performed using an exposure apparatus according to any one of claims 1 through 30.

44. A device manufacturing method including a lithography process, wherein in said lithography process, exposure is performed using an exposure method according to one of claims 38 and 39.

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45. (Added) An exposure apparatus that transfers a pattern of a mask onto a substrate by irradiating said mask with exposure-illumination light, said mask having a thin film attached thereto via a frame, the exposure

10 apparatus comprising:

a gas-replacement room in which a space enclosed by said thin film, said frame and said mask is filled with specific gas having a characteristic of absorbing little of said exposure illumination light.

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46. (Added) An exposure apparatus according to claim 45, further comprising:

a mask room that covers at least an optical path
near said mask of the optical path of said exposure-
illumination light from said mask to said substrate; and

wherein said gas-replacement room is arranged adjacent to said mask room.

47. (Added) An exposure apparatus according to
25 claim 45, wherein said frame has a plurality of gas vents,
and wherein said space is filled with said specific gas
through said gas vents of said frame.

48. (Added) An exposure apparatus according to claim 47, wherein the filling of said space with said specific gas is performed by supplying said specific gas to said gas-replacement room and to said space through said gas vents after discharging gas in said gas-replacement room to decrease the internal pressure.

49. (Added) An exposure apparatus according to claim 45, wherein said thin film is made of crystal material.

A11- 50. (Added) An exposure apparatus that transfers a pattern of a mask onto a substrate by irradiating said mask with exposure-illumination light, the exposure apparatus comprising:

a plurality of sealed rooms in each of which said mask is temporarily stored, including a mask room that covers at least an optical path near said mask of the optical path of said exposure-illumination light from said mask to said substrate;

a transport mechanism that transports said mask between said plurality of sealed rooms; and

an energy-beam-emitting portion that is provided in
a path for transporting said mask and irradiates said
25 mask with an energy beam in an ultraviolet range.

51. (Added) An exposure apparatus according to claim 50, wherein a mask-reserve room is provided which

is arranged adjacent to said mask room and which temporarily contains said mask before being transported into said mask room, and

wherein said energy-beam-emitting portion is
5 arranged in said mask reserve room.

52. (Added) An exposure apparatus according to claim 51, wherein said energy-beam-emitting portion is an excimer lamp.

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15 33. (Added) An exposure method that transfers a pattern of a mask onto a substrate by irradiating said mask with exposure-illumination light, said mask having a thin film attached thereto via a frame, the exposure method comprising:

a first step of filling a sealed space that covers at least an optical path near said mask of the optical path of said exposure-illumination light from said mask to said substrate with low-absorbent gas that has a characteristic of absorbing little of said exposure illumination light;

a second step of filling a space enclosed by said thin film, said frame and said mask with specific gas having a characteristic of absorbing little of said exposure illumination light before transporting said mask into said sealed space; and

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a third step of transporting said mask onto a predetermined position in said sealed space and transferring said pattern onto said substrate.

54. (Added) An exposure method that transfers a pattern of a mask onto a substrate by irradiating said mask with exposure-illumination light, the exposure method comprising:

10 a first step of filling a sealed space that covers at least an optical path near said mask of the optical path of said exposure-illumination light from said mask to said substrate with low-absorbent gas that has a characteristic of absorbing little of said exposure illumination light;

15 a second step of irradiating said mask with an
energy beam in an ultraviolet range before transporting
said mask into said sealed space; and

a third step of transporting said mask onto a predetermined position in said sealed space and transferring said pattern onto said substrate.